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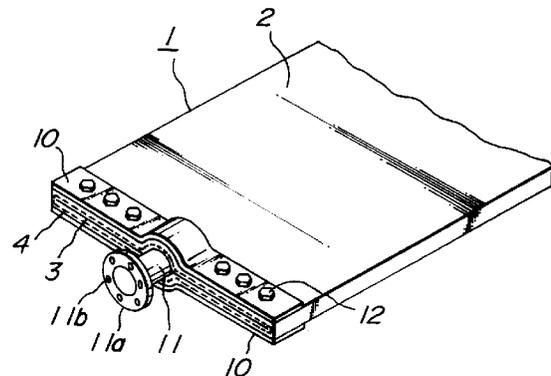
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Flat hoses for use in the compaction of soft ground and compaction method using the same.

A flat hose (1) for use in the compaction of soft ground through a water loading method comprises a flexible plate body (2) composed of a rubbery elastomeric material and provided in a deflated state with a hollow split portion (3) at a predetermined position in a thickness direction and extending along a lengthwise direction thereof. The split portion (3) terminates at each side end with a solid fin portion (22) extending in the thickness direction and defines an inflating chamber by the supply of water. These flat hoses are arranged on soft ground to be compacted side by side and piled one upon the other in pyramid form and then inflated by the supply of water.

FIG. 2



This invention relates to a flat hose for use in the compaction of soft ground through water loading method and a compaction method using the same.

It is well-known that a loading method is used in the compaction, backfilling, or banking of soft ground. In this case, a load equal to or larger than a weight of a structural body is previously applied to a soft base ground prior to the execution of the structural body to promote consolidation settlement of such a ground and increase a strength thereof till the quantity of the settlement or the strength level reaches to a previously anticipated level. After the compaction of the soft ground, the load is removed and then the structural body is executed on the compacted ground. According to this method, the distance between mutual soil particles becomes smaller to increase the earth density and decrease the water permeability and hence increase the shearing resistance of the soil.

In general, embankment is used in the above loading method. However, an area to be effectively compacted with the embankment is about 1/4 of an area of the embankment, so that the use of the embankment is impossible when an area of soft ground to be compacted is less than 4 times of an area of a structural body to be executed. Furthermore, earth for the embankment is get from a given place and carried onto a working site and then removed off from the working site after the completion of the compaction, so that a great number of working steps is required. Moreover, the scattering of dusts is caused in surroundings in the transportation of the earth or at a dry state of the embankment. That is, the use of the embankment has many problems in view of economical reasons and environment.

Recently, there is developed a water loading method wherein a plurality of hoses are arranged on soft ground side by side instead of the embankment and water is filled in these hoses. For example, JP-A-1-278613 proposes a preload member used for the improvement of soft ground through preloading method consisting of a rubber or synthetic resin tube provided at both ends with taps for supply and discharge of water. Furthermore, this article discloses that a plurality of preload members are arranged side by side on a structure fill placed on soft ground having a space substantially equal to an area of an institution to be executed and a plurality of the preload members are further placed on the tube row in the same direction or a direction perpendicular to the tube direction of this row and then water is filled in all of these preload members.

In the water loading method, only a space substantially equal to the size of the institution is required as an area of soft ground to be compacted, and also the operation of arranging and removing the preload members is easy, so that the problems caused in the use of the embankment can be solved.

However, the tube of the preload member used

has an original shape corresponding to a cylindrical shape created by the filling of water, so that when water is discharged from the inside of the tube to deflate the tube, a curved swelling is formed in each side portion of the tube at the deflated state thereof without being flattened owing to the thickness of the tube as shown in Fig. 1. As a result, water still remains in the swelling, which obstructs the removal work of the preload member after the completion of the soft ground compaction. Furthermore, the swellings at both side portions of the tube at the deflated state are voluminous, so that when the tube is wound round a reel or the like, the winding can not efficiently and compactly be conducted and also a large space is required in the transportation and storage of the wound tube.

It is, therefore, an object of the invention to provide a flat hose for use in the compaction of soft ground through water loading method capable of completely discharging water from the inside of the hose at a deflated state and conducting compact winding and facilitating the transportation and storage of the hose.

According to a first aspect of the invention, there is the provision of a flat hose for use in the compaction of soft ground through water loading method comprising; a flexible plate body composed of a rubbery elastomeric material and provided in a deflated state with a hollow split portion at a predetermined position in a thickness direction and extending along a lengthwise direction thereof; said split portion terminating at each side end with a solid fin portion extending in the thickness direction; said split portion in an inflated state defining an inflated chamber and receiving a supply of water.

In a preferred embodiment of the invention, each of both end portions of the hose in the lengthwise direction thereof is sandwiched between a pair of keep members and a flanged connection pipe is water-tightly inserted into the end portion between the keep members so as to communicate with the hollow split portion.

In another preferred embodiment of the invention, the flexible plate body is provided with a reinforcing layer around the hollow split portion.

In the other preferred embodiment of the invention, coupling holes are formed in the solid fin portion at given intervals in the lengthwise direction.

According to a second aspect of the invention, there is the provision of a method of compacting soft ground, which comprises arranging a plurality of flat hoses as defined above side by side on a structure fill placed on a soft ground in a volume corresponding to a given settlement volume of the soft ground to form a first stage comprised of these flat hoses, piling a plurality of flat hoses on the first stage and arranging them side by side while shifting from the first stage only by a given pitch to form a second stage comprised of these flat hoses, and then successively

supplying water into each of the flat hoses from the first stage to fourth stage to inflate these hoses.

In a preferred embodiment of the invention, when the flat hoses are arranged side by side and piled one upon the other to form at least four stages of pyramid form, the flat hose in the second stage is shifted by a half pitch from the flat hose in the first stage, and the flat hose in the third stage is shifted by 1/4 pitch from the flat hose in the second stage, and the flat hose is shifted by a half pitch from the flat hose in the fourth stage.

In another preferred embodiment of the invention, vibrations are forcedly applied to water filled in the inflated hoses by means of a vibrator or pump.

In the other preferred embodiment of the invention, the flat hoses arranged in at least a first stage are connected to each other, in which at least three flat hoses located at each outward end of the stage are connected to each other. Alternately, two flat hoses located at each outward end of each stage are connected to each other.

According to the invention, the hose itself is comprised of flat flexible plate body, so that when water is discharged from the hollow split portion of the plate body after use, the plate body is immediately turned into the original flat shape, whereby the discharge of water can completely be conducted. Furthermore, the hose can efficiently and compactly be wound round the reel or the like at the deflated state, which can facilitate the transportation and storage of the wound hose.

The invention will be described with reference to the accompanying drawings, wherein:

Fig. 1 is a section view of the conventional cylindrical tube at a deflated state;

Fig. 2 is a partially perspective view of a first embodiment of the flat hose according to the invention;

Fig. 3 is a perspective view illustrating a state of arranging a plurality of the flat hoses according to the invention side by side;

Fig. 4 is a partially perspective view illustrating a state of inflating the flat hoses according to the invention by supply of water;

Fig. 5 is a partially perspective view of a second embodiment of the flat hose according to the invention;

Fig. 6 is a section view taken along a line VI-VI of Fig. 5;

Fig. 7 is a section view showing a modified embodiment of Fig. 6;

Fig. 8 is a partially perspective view of a third embodiment of the flat hose according to the invention;

Fig. 9 is a section view taken along a line IX-IX of Fig. 8;

Fig. 10 is a section view of a fourth embodiment of the flat hose according to the invention;

Fig. 11 is a diagrammatic view of a coupling metal member for connecting adjacent joint holes between adjoining solid fin portions to each other; Fig. 12 is a schematically partial section view illustrating a state of piling the flat hoses according to the invention one upon the other on a structure fill placed on soft ground;

Fig. 13 is a diagrammatical view illustrating a state of inflating flat hoses at a first stage by the supply of water;

Fig. 14 is a diagrammatical view illustrating a state of inflating flat hoses at a second stage by the supply of water;

Fig. 15 is a diagrammatical view illustrating a state of inflating flat hoses at third and fourth stages by the supply of water;

Fig. 16 is a diagrammatically partial section view illustrating a water loading method with the flat hoses shown in Fig. 5;

Fig. 17 is a diagrammatically section view illustrating a state of arranging different flat hoses between a structure fill and a lowest row comprised of flat hoses for preventing falling down of inflated hoses from the outward end of the lowest row in the compaction of soft ground;

Fig. 18 is a diagrammatically section view illustrating a state of inflating different flat hoses shown in Fig. 17 by the supply of water for preventing falling down of inflated hoses from the outward end of the lowest row when uneven settlement of soft ground is caused;

Fig. 19 is a diagrammatically partial section view illustrating another embodiment for preventing falling down of inflated hoses from the outward end of the lowest row when uneven settlement of soft ground is caused;

Fig. 20 is a diagrammatically partial section view illustrating the other embodiment for preventing falling down of inflated hoses from the outward end of the lowest row when uneven settlement of soft ground is caused;

Fig. 21 is a schematically front view illustrating a first embodiment of compacting soft ground through water loading method using flat hoses according to the invention; and

Fig. 22 is a schematically front view illustrating a second embodiment of compacting soft ground through water loading method using flat hoses according to the invention.

In Fig. 2 is perspectively shown an end portion of a first embodiment of the flat hose according to the invention. The flat hose 1 comprises a flexible plate body 2 composed of a rubbery elastomeric material such as rubber, polyvinyl chloride or the like and provided in a deflated state with a hollow split portion 3 at a predetermined position in a thickness direction and extending along a lengthwise direction thereof. The hollow split portion 3 terminates at each side end

with a solid fin portion extending in the thickness direction. Further, the hollow split portion 3 in an inflated state defines an inflated chamber and receives a supply of water.

In the flexible plate body 2 is embedded a flexible reinforcing layer 4 of a flat cylindrical shape surrounding the hollow split portion 3. The reinforcing layer 4 is comprised of a canvas or a bias cut weave fabric of a synthetic fiber such as polyamide fiber, polyester fiber, aramide fiber or the like.

When the flexible plate body 2 is inflated by supplying water into the hollow split portion 3, the breakage being particularly apt to be caused in both solid fin portions can be prevented by the reinforcing layer 4 surrounding the hollow split portion 3.

Moreover, fine undulations may be formed in the outer surface of the plate body or an anti-slipping material such as ceramic particles or the like may be applied to the outer surface of the plate body for the prevention of slipping.

As shown in Fig. 2, each of both end portions of the plate body 2 in the lengthwise direction thereof is sandwiched between a pair of keep members 10 each having, for example, a semi-circular curved portion and a flanged connection pipe 11 is watertightly inserted into the end portion between the keep members 10 so as to communicate with the hollow split portion 3 and fixed at both sides thereof with the keep members 10 by bolts and nuts 12. In order to more ensure the watertightness, the flanged connection pipe 11 may be provided at its periphery with a flexible packing (not shown) which is symmetrical in configuration with respect to the center axis of the pipe and is gradually tapered from the up and down sides toward the left and right sides in a direction perpendicular to the center axis of the pipe. Furthermore, bolt holes 11b is formed in a flange portion 11a of the flanged connection pipe 11.

According to the invention, the flat hose 1 is used for the compaction of soft ground as shown in Fig. 3. That is, a plurality of the flat hoses 1 are arranged side by side on a structure fill (not shown) placed on soft ground (not shown), wherein the flanged connection pipes located at the adjacent end portions between the mutual flat hoses 1 are connected to a U-shaped joint pipe 13 having flange portions 13a at both ends thereof and the joint pipes 13 are zigzag arranged with respect to the lengthwise direction of the flat hose arrangement. In this case, each of the joint pipe 13 is secured to the flanged connection pipe 11 by interposing a seal member (not shown) between the flange portions 11a and 13a and passing bolts 14 through bolt holes formed in the flange portions and fastening with nuts.

The flanged connection pipe 13 of an outermost flat hose 1 not connected to the joint pipe 13 is clogged with a cover member 16, while the flanged connection pipe 13 of the other outermost flat hose 1 not

connected to the joint pipe 13 is connected to a pipe 17 for the supply and discharge of water.

Once water is supplied into the hollow split portion 3 of the outermost flat hose 1 through the pipe 20, water penetrates into the hollow split portion 3 of the next flat hose 1 through the joint pipe 13 one after another to successively inflate the hollow split portions 3 of the flexible plate bodies 2. As shown in Fig. 4, the flexible plate body 2 is inflated into a substantially cylindrical form other than the end portions sandwiched between the keep members and the solid fin portions by water filled in the hollow split portion 3.

In the compaction of soft ground, a plurality of the flat hoses 1 are arranged side by side on a space to be compacted corresponding only to an area of an institution as shown in Fig. 3. Moreover, these flat hoses 1 are piled one upon the other at multi stages in form of a pyramid so as to provide water loading enough to compact the soft ground up to a given settlement volume when water is supplied to these flat hoses. After the completion of the soft ground compaction, water is discharged from the inside of each of the inflated hoses 1. Since the flat hose 1 has a flat shape by nature, the inflated hose 1 is substantially completely deflated to the original flat shape as shown in Fig. 2 during the discharge of water from the inside of the inflated split portion. As a result, the deflated flat hose can easily be removed from the compacted soft ground. In the removal operation, the deflated flat hose can efficiently and compactly be wound round the reel. Since the compactly wound flat hose is not required to have a wide space in the transportation and storage, a great number of flat hoses 1 can be transported and stored at once.

When the flat hoses 1 are piled one upon another at the multi stages, the adjoining flat hoses 1 are connected to each other through the connection pipe 13 and the fine undulations are formed on the outer surface of the flat hose 1, so that there is not caused the falling down of the inflated hose 1 from the multi-stage piled inflated hoses unless the piling height is extreme.

In Fig. 5 is shown a second embodiment of the flat hose according to the invention, which is a modified embodiment of Fig. 2. That is, the flat hose 20 comprises a flexible plate body 21 composed of a rubbery elastomeric material such as rubber, polyvinyl chloride or the like and provided in a deflated state with a hollow split portion 3 at a predetermined position in a thickness direction and extending along a lengthwise direction thereof. The hollow split portion 3 terminates at each side end with a solid fin portion 22 extending in the thickness direction. Further, the hollow split portion 3 in an inflated state defines an inflated chamber and receives a supply of water.

In the flexible plate body 21 is embedded a flexible reinforcing layer 4 of a flat cylindrical shape surrounding the hollow split portion 3. The reinforcing

layer 4 is comprised of a canvas or a bias cut weave fabric of a synthetic fiber.

As shown in Fig. 6, each of the solid fin portions 22 is reinforced with a pair of fiber reinforcing layers 24 embedded in the plate body 21 and provided with a plurality of joint holes 26 formed at a given pitch in the lengthwise direction of the plate body.

As shown in Fig. 7, a pair of fiber reinforcing layers 25 may be embedded in the plate body over substantially a full width thereof instead of the fiber reinforcing layer 24 in addition to the reinforcing layer 4.

In Fig. 8 is shown a third embodiment of the flat hose according to the invention, which is a modified embodiment of Fig. 5. The flat hose 30 has the same structure as in the flat hose 20 except that a rubber cut-out portion 32 is formed in the solid fin portion 22 between the adjacent joint holes 26 for reducing the weight of the flat hose. As shown in Fig. 9, a ring-shaped metal reinforcement 34 is embedded around the joint hole 26.

In Fig. 10 is shown a fourth embodiment of the flat hose according to the invention, which is a modified embodiment of Fig. 7. The flat hose 40 has the same structure as in the flat hose of Fig. 7 except that an upper solid fin portion 42a and a lower solid fin portion 42b are formed on both sides of the plate body in the widthwise direction with respect to a center line of the plate body in the thickness direction as shown in Fig. 10. The upper solid fin portion 42a of the flat hose 42 is piled on the lower solid fin portion 42b of the adjacent flat hose 42.

As shown in Fig. 11, the flat hoses 20 are connected to each other by fitting opposed hook portions 50a of a coupling metal member 50 into joint holes 26 of the adjoining flat hoses 20. Moreover, the connection between the adjoining flat hoses may be conducted by using a rope or the like instead of the coupling metal member 50.

The compaction of soft ground using the aforementioned flat hose according to the invention will be described in detail below.

As shown in Fig. 12, a plurality of flat hoses 1 each defining an inflated chamber of, for example, 1 m in diameter at an inflated state are arranged side by side and at the same time piled one upon the other up to four stages in form of a pyramid. Numeral 60 is a soft ground to be compacted, and numeral 62 a structure fill placed on the soft ground 60 in a volume corresponding to a given settlement volume of the soft ground.

At first, a plurality of flat hoses 1₋₁ are arranged on the structure fill 62 side by side at a constant pitch (2.1 m) to form a first stage A comprised of the flat hoses 1₋₁. Then, a plurality of flat hoses 1₋₂ are piled on the first stage A and arranged side by side while shifting from the first stage A only by a half pitch to form a second stage B comprised of the flat hoses 1₋₂.

Next, a plurality of flat hoses 1₋₃ are piled on the second stage B and arranged side by side while shifting from the second stage B only by 1/4 pitch to form a third stage C comprised of the flat hoses 1₋₃. Thereafter, a plurality of flat hoses 1₋₄ are piled on the third stage C and arranged side by side while shifting from the third stage C only by a half pitch to form a fourth stage D comprised of the flat hoses 1₋₄.

As shown in Fig. 13, when the flat hoses 1₋₁ of the first stage A are inflated by the supply of water, each of the flat hoses 1₋₂ locates between the adjoining inflated hoses 1₋₁. Then, when the flat hoses 1₋₂ of the second stage B are inflated by the supply of water, each of the inflated hoses 1₋₂ locates between the adjoining inflated hoses 1₋₁ to form a first row H comprised of the inflated hoses 1₋₁ and 1₋₂ as shown in Fig. 14. Thereafter, when the flat hoses 1₋₃ and 1₋₄ of the third and fourth stages C and D are inflated by the supply of water, the inflated hoses 1₋₃ and 1₋₄ are alternately arranged side by side to form a second row I as shown in Fig. 15.

As previously mentioned, water may be supplied to the flat hoses 1 through the flanged connection pipe 13 connecting the flat hoses to each other, or the supply of water may be conducted every the flat hose 1.

In the arrangement of the flat hoses as shown in Fig. 12, the adjoining flat hoses 1 arranged side by side are connected to each other by using a proper rope, band or the like. In this case, the length of the rope is desirable to be not less than a half of a circumference of the inflated hose. Alternatively, plural clamping bands (not shown) are secured at one end to the structure fill at an interval of 5 m for clamping the inflated hoses to prevent the fall down of the inflated hose from the upper stage or the like.

In case of the flat hose having the solid fin portion provided with the joint holes, as shown in Fig. 16, at least three flat hoses 20₋₁, 20₋₂, 20₋₃ located at each outward end of each of first to third rows H, I, J are connected to each other by connecting the opposed joint holes between the adjoining flat hoses with the coupling metal members. Moreover, all flat hoses of each row may be connected to each other with the coupling metal members, ropes, bands or the like, if necessary.

Even when the adjoining inflated hoses in each row are connected to each other as mentioned above, there is caused a risk of falling down the inflated hose from the row due to uneven settlement of the soft ground. That is, if the soft ground is unevenly settled, the inflated hose begins to fall down from the upper row of the piled flat hoses. Particularly, when the falling down of the inflated hose is caused at the outer end of the row in the pyramid-shaped piling, great damage is brought on not only workers operating

around the piled rows but also monitoring devices and operating devices. Therefore, it is strongly demanded to prevent the falling down of the inflated hose from the piled rows in the water loading method.

According to the invention, when a plurality of the flat hoses 20 are arranged on the structure fill 62 placed on the soft ground 60 side by side and piled one upon the other in pyramid form (two rows in the illustrated embodiment), a flat hose 70 having an inflating diameter larger than that of the flat hose 20 is interposed between the outward end of the first row H and the structure fill 62 as shown in Fig. 17. If the soft ground 60 is unevenly settled during the compaction of the soft ground after the inflation of the flat hoses 20 by the supply of water, water is supplied to the inside of the flat hose 70 as shown in Fig. 18, whereby the inflated hoses 20 ride on the inflated hose 70 to prevent the fall down of the inflated hoses 20 from the outward end of the first row H. Moreover, the flat hose 70 may previously be shaped to have substantially a triangular form in section at an inflated state.

Alternatively, a rigid plate 72 is interposed between the inflated hoses 20 of the lowest row and the structure fill 62 and the flat hose 70 is disposed between the rigid plate 72 and the structure fill 62 as shown in Fig. 19. In this case, the rigid plate 72 is lifted upward by supplying water into the flat hose 70 to prevent the fall down of the inflated hoses 20 if the uneven settlement of soft ground is caused. In this case, the flat hose 70 may integrally bonded to the rigid plate 72 by vulcanization.

As shown in Fig. 20, at least two flat hoses 74 having an inflating diameter larger than that of the flat hose 20 are located at each outward end of the lowest row comprised of the flat hoses 20 and connected to each other. If the abnormal or uneven settlement of the soft ground is caused, the fall down of the inflated hoses 20 located at the outward end of the upper row is prevented by the inflation of the flat hoses 74 by the supply of water.

In general, a construction period for the compaction of soft ground through the water loading method is required to be about 2-3 months. According to circumstances, it is demanded to shorten the construction period as far as possible. For this purpose, there are adopted various means for forcedly vibrating water filled in the inflated hose such as vibrators, pumps and the like. When such a vibration generating device is used, vibration frequency can freely be changed in accordance with soft ground strata to be compacted, loading state and the like, but is desirable to be about 0.1-1 Hz.

As shown in Fig. 21, after the flat hoses 1₋₁, 1₋₂ and 1₋₃ are arranged side by side and piled one upon the other at three rows H, I and J in a pyramid form and then inflated by the supply of water, a vibration

generating device 80 fixed onto the inflated hoses 1₋₃ of the upper third row J is actuated by applying voltage to directly transfer vibrations to the inflated hoses 1₋₃, whereby water filled in the inflated hose 1₋₃ is vibrated, which is transferred through the inflated hoses 1₋₂ and 1₋₁ and the structure fill 62 to the soft ground 60 to promote the compaction of the soft ground 60. Moreover, the vibration generating device 80 may be disposed between the third row J and the second row I or between the second row I and the first row H, or may be arranged on outer side face of each of the rows H, I and J.

As shown in Fig. 22, the compaction of soft ground may be promoted by actuating a pump 82 possessing a function of repeatedly feeding water under pressure, which is connected to the several inflated hoses 1-3 of the upper third row J through respective connecting pipes 84, to vibrate water filled in these inflated hoses 1-3.

As mentioned above, according to the invention, the hose to be used is originally a flat plate body composed of a rubbery elastomer material having a hollow split portion therein, so that when the hose inflated by the supply of water is deflated by the discharge of water, the shape of the hose becomes flat and hence water can completely be discharged from the inside of the inflated hose. As a result, the deflated hose can efficiently and compactly be wound round the reel or the like and also the transportation and storage of the wound hose become easy. Furthermore, a plurality of such flat hoses are arranged side by side on a structure fill placed on a soft ground to be compacted connected to each other through a connecting pipe at the deflated state, so that the arrangement of the flat hoses in the multi-stage piling of pyramid form is easy and accurate. Moreover, a plurality of joint holes are formed in each solid fin portion of the plate body at given intervals in the lengthwise direction thereof, so that when the solid fin portions of the adjoining plate bodies arranged side by side are connected to each other by connecting the joint holes with each other through coupling metal members or ropes, the fall down of the inflated hose from the outward end of each of the piled rows can be prevented.

Claims

1. A flat hose (1;20;30;40) for use in the compaction of soft ground through a water loading method, comprising: a flexible plate body (2;21) composed of a rubbery elastomeric material and provided in a deflated state with a hollow split portion (3) at a predetermined position in a thickness direction and extending along a lengthwise direction thereof; the split portion (3) terminating at each side end with a solid fin portion

- (22;42a,42b) extending in the thickness direction; and the split portion (3) in an inflated state defining an inflated chamber for receiving a supply of water.
2. A flat hose as claimed in claim 1, characterized in that each of both end portions of the hose in the lengthwise direction thereof is sandwiched between a pair of keep members (10) and a flanged connection pipe (11) is watertightly inserted into the end portion between the keep members (10) so as to communicate with the hollow split portion (3).
 3. A flat hose as claimed in claim 1 or 2, characterized in that the flexible plate body (2) is provided with a reinforcing layer (4) around the hollow split portion (3).
 4. A flat hose as claimed in any of claims 1 to 3, characterized in that coupling holes (26) are formed in the solid fin portion (22;42a,42b) at given intervals in the lengthwise direction.
 5. A method of compacting soft ground, which comprises arranging a plurality of flat hoses (1) as claimed in any of claims 1 to 4 side by side on a structure fill (62) placed on soft ground (60) in a volume corresponding to a given settlement volume of the soft ground to form a first stage (A) comprised of said flat hoses, piling a plurality of flat hoses on the first stage and arranging them side by side while shifting from the first stage only by a given pitch to form a second stage (B) comprised of said flat hoses, and then successively supplying water into each of the flat hoses from the first stage to a fourth stage (D) to inflate said hoses.
 6. A method as claimed in claim 5, characterized in that, when the flat hoses (1) are arranged side by side and piled one upon the other to form at least four stages (A-D) of pyramid form, the flat hose in the second stage (B) is shifted by a half pitch from the flat hose in the first stage (A), and the flat hose in the third stage (C) is shifted by 1/4 pitch from the flat hose in the second stage, and the flat hose is shifted by a half pitch from the flat hose in the fourth stage (D).
 7. A method as claimed in claim 5 or 6, characterized in that vibrations are forcedly applied to water filled in the inflated hoses.
 8. A method as claimed in claim 7, characterized by forcedly applying vibrations to water filled in the inflated hoses by means of a vibrator (80) or pump (82).
 9. A method as claimed in any of claims 5 to 8, characterized in that the flat hoses arranged in at least a first stage are connected to each other.
 10. A method as claimed in claim 9, characterized in that at least three flat hoses located at each outward end of the first stage are connected to each other.
 11. A method as claimed in any of claims 5 to 8, characterized in that two flat hoses located at each outward end of each stage are connected to each other.

FIG. 1
PRIOR ART



FIG. 2

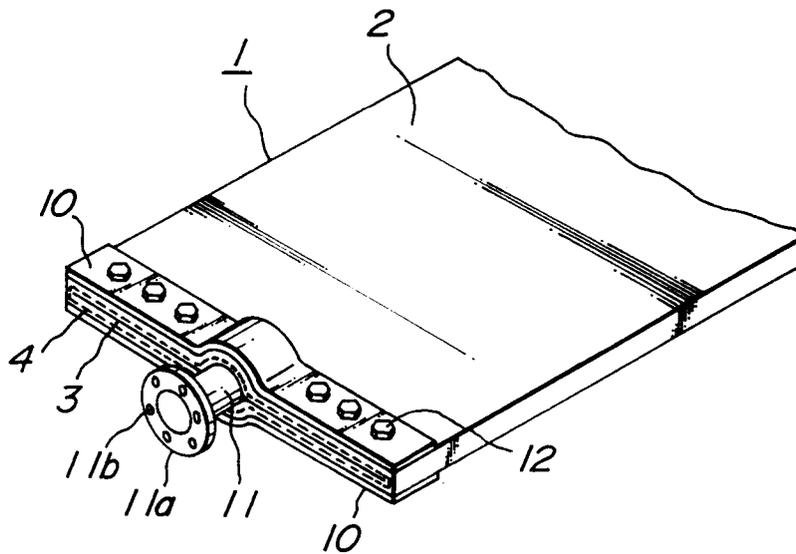


FIG. 3

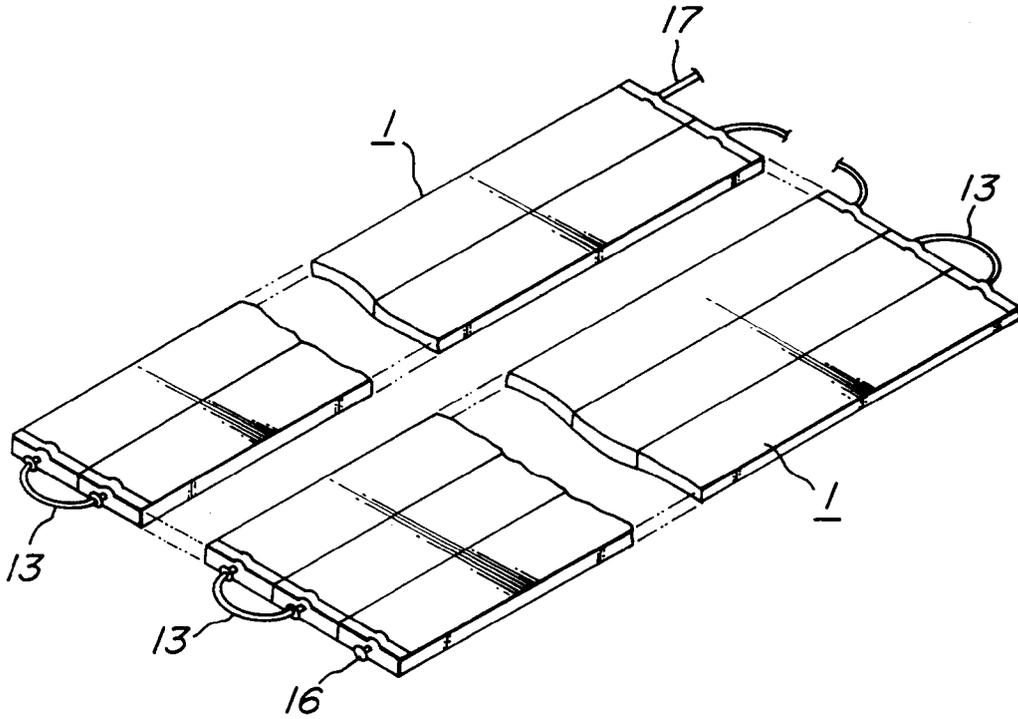


FIG. 4

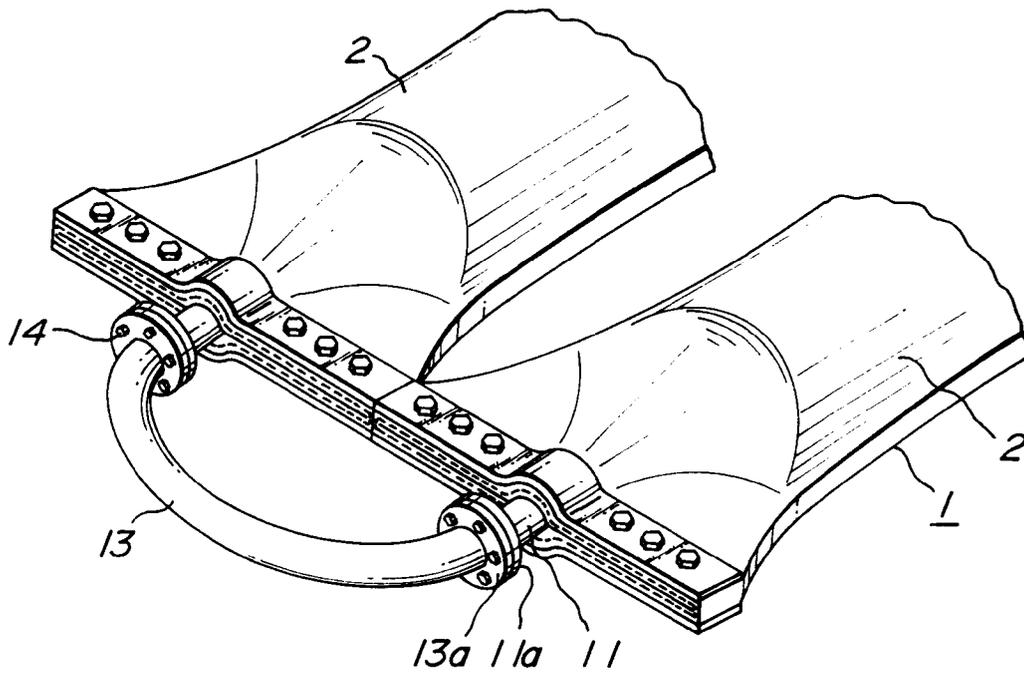


FIG. 5

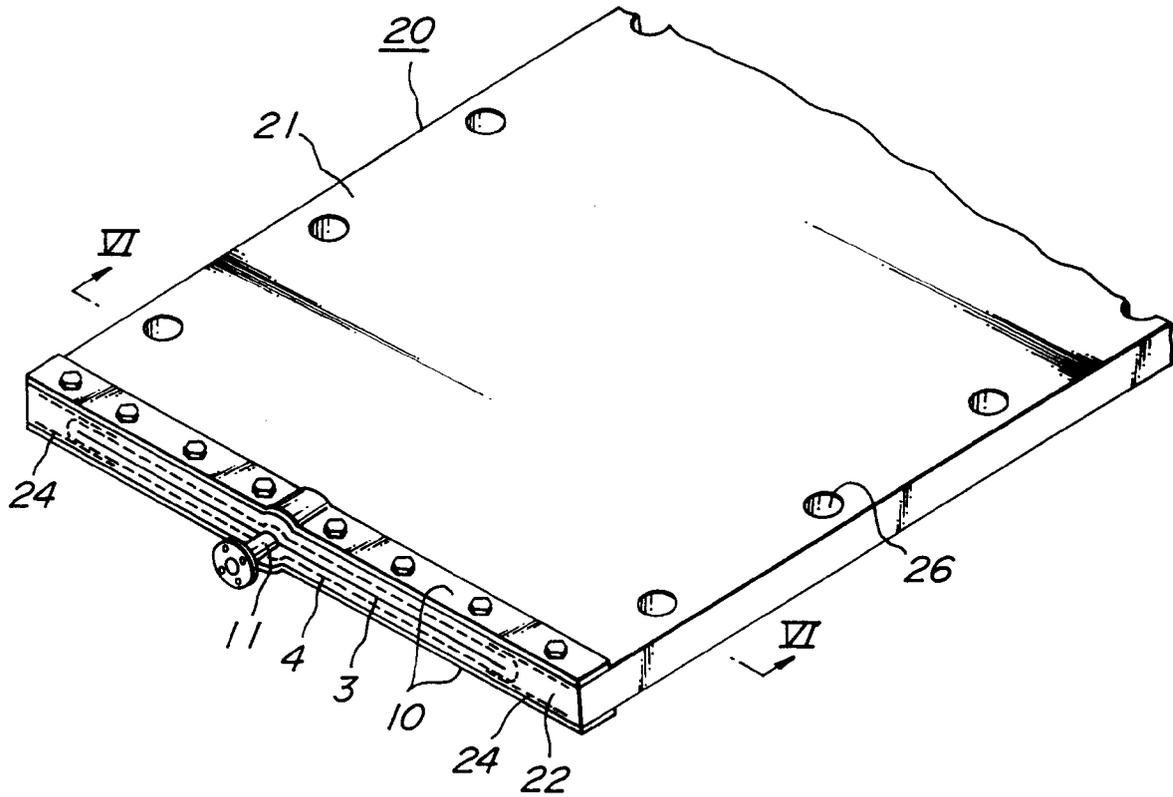


FIG. 6

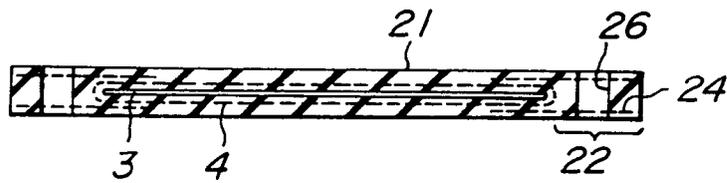


FIG. 9

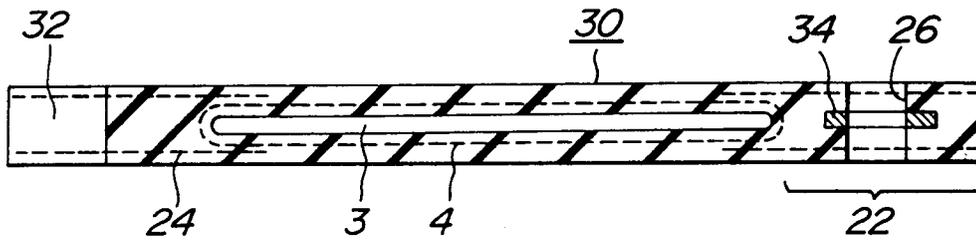


FIG. 10

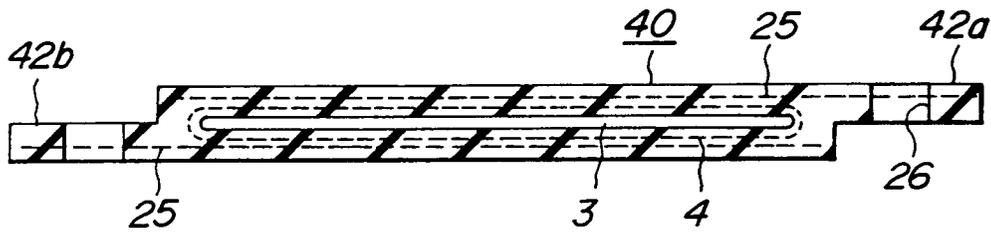


FIG. 11

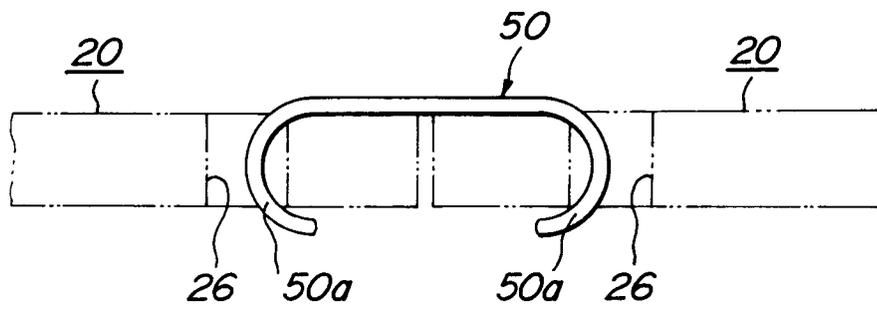


FIG. 12

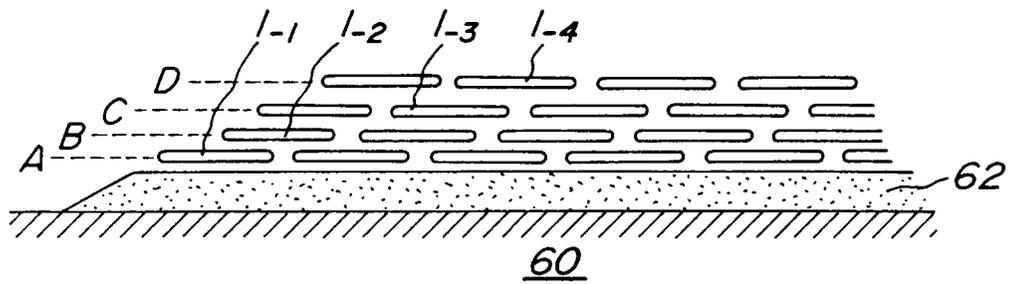


FIG. 13

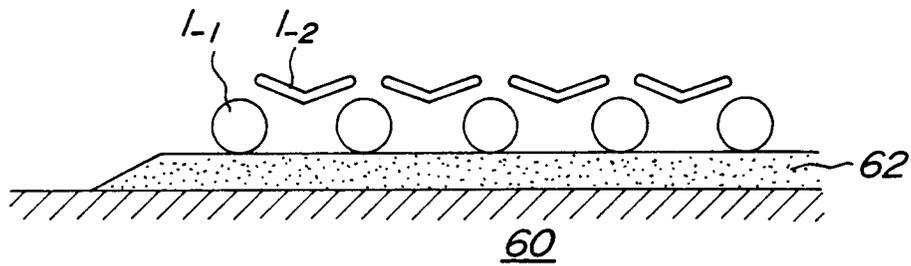


FIG. 14

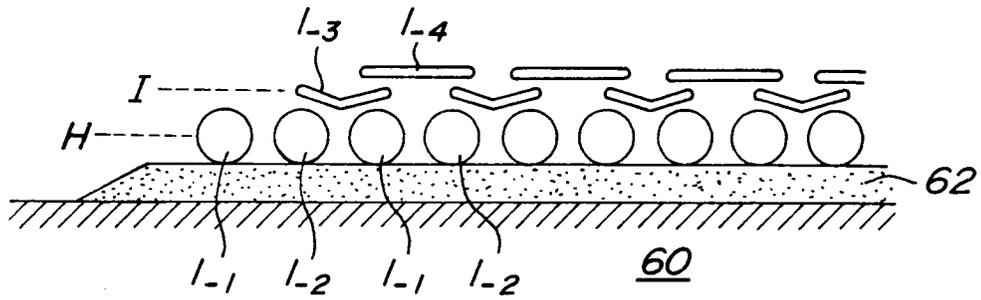


FIG. 15

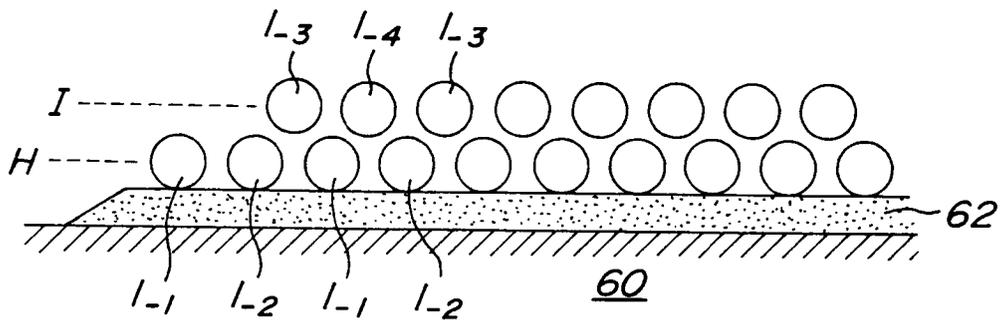


FIG. 16

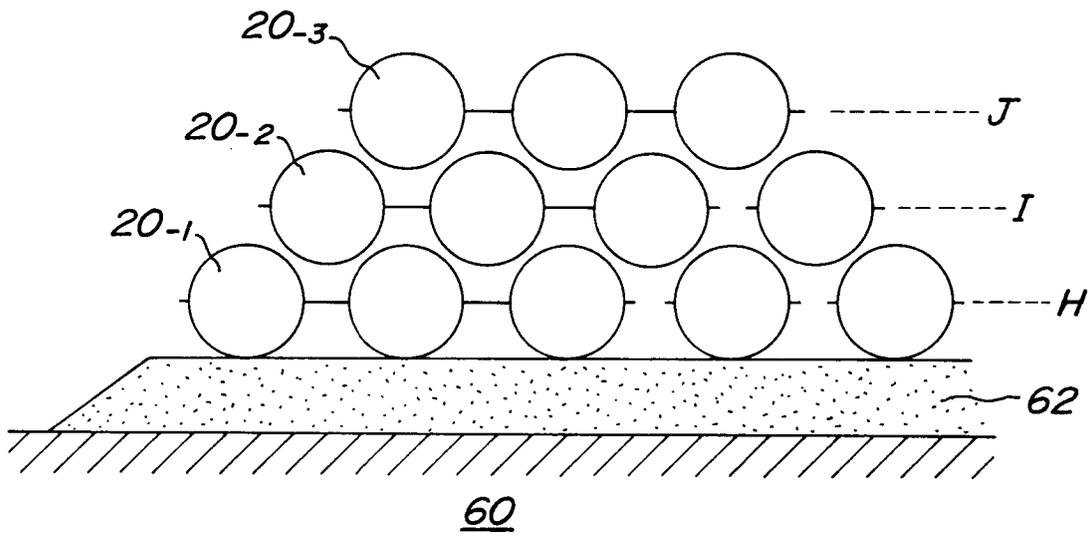


FIG. 17

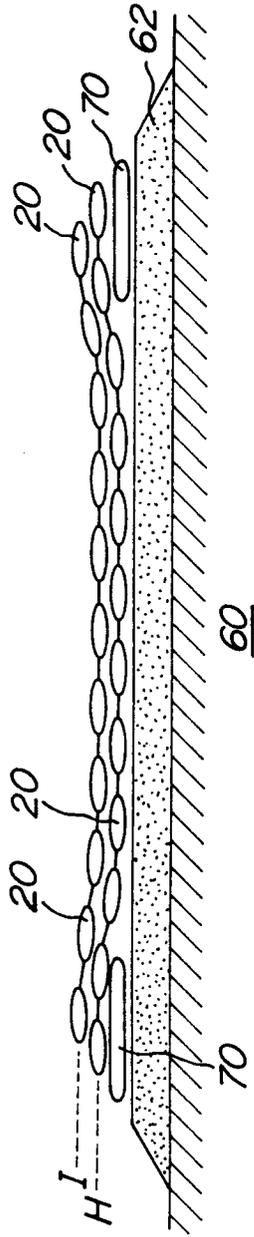


FIG. 18

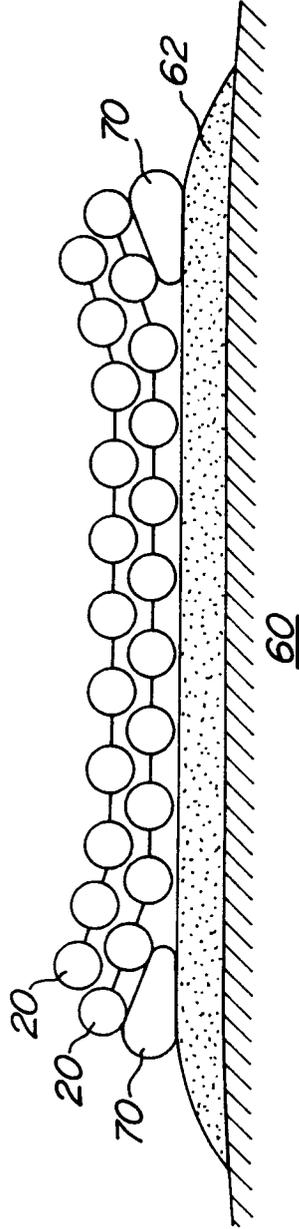


FIG. 19

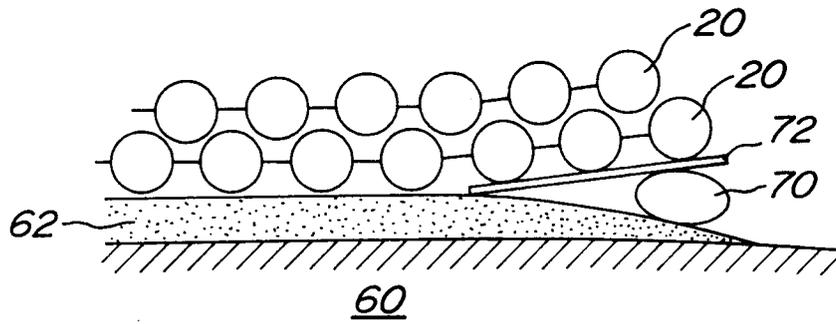


FIG. 20

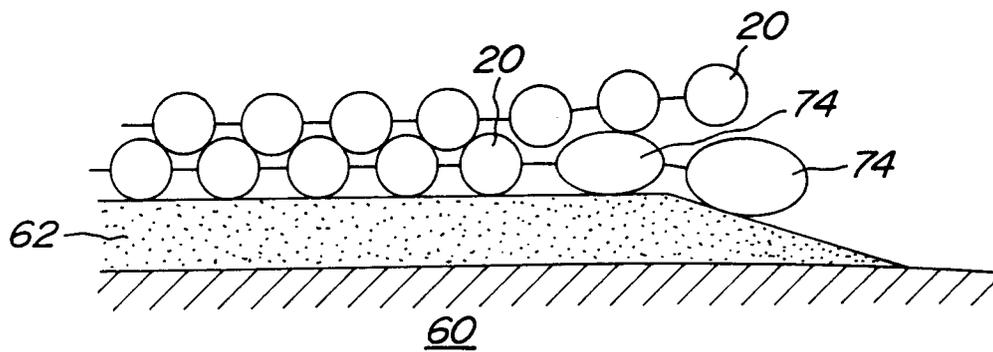


FIG. 21

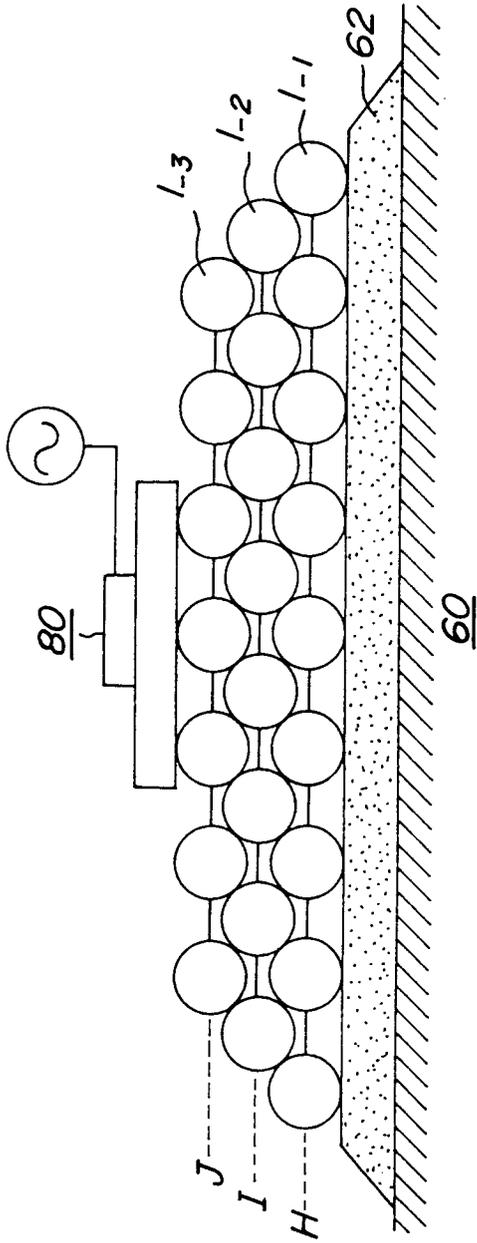
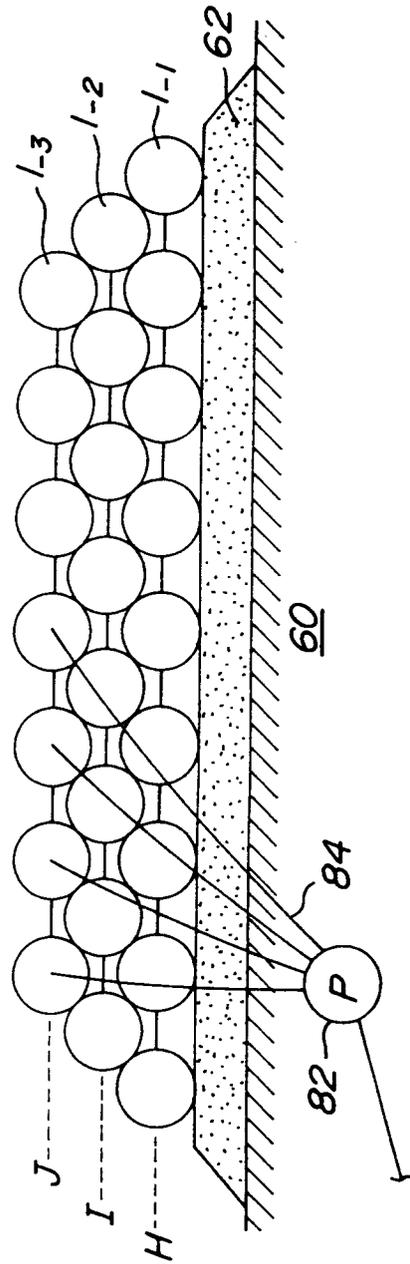


FIG. 22





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 2811

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	PATENT ABSTRACTS OF JAPAN vol. 014 no. 049 (M-0927) ,29 January 1990 & JP-A-01 278613 (FUJITA CORP) 9 November 1989, * abstract *	1,4-6, 9-11	E01B3/02
A	--- PATENT ABSTRACTS OF JAPAN vol. 006 no. 240 (M-174) ,27 November 1982 & JP-A-57 137515 (KAZUMI YAMAOKA) 25 August 1982, * abstract *	1,3-5,9	
A	--- PATENT ABSTRACTS OF JAPAN vol. 006 no. 267 (M-182) ,25 December 1982 & JP-A-57 158414 (KAZUMI YAMAOKA) 30 September 1982, * abstract *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E01B E01C E02D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 July 1995	Examiner Blommaert, S
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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